FISHERIES MANAGEMENT

The term "management" as it applies to fisheries can be considered in the same context as the management of a factory or farm. A farmer tries to produce a crop of foodstuffs for man's benefit in the same way that a fisheries manager attempts to produce a crop of game fishes for anglers to enjoy.

Both farm and fisheries managers try to avoid so-called "biological deadends"; i.e., "crops" that man cannot or will not use for his personal benefit. Weeds in the farmer's field which steal nutrients from usable plants are one example of a biological deadend. Another might be the insects which consume a desirable crop before it can be brought to harvest.

Fisheries managers also have biological deadends to contend with. Examples include large populations of fishes such as carp which sometimes crowd out the trout and bass which man considers more desirable. A large unutilized forage fish population is a biological deadend, as are dwarfed game fishes which have depleted their food supply and which anglers find unattractive and are unwilling to utilize.

The crop which farm and fisheries managers produce is at the end of a food chain, or put another way, at the end of a series of energy transfers. A schematic (and purposely oversimplified) fishery food chain might be: chemical nutrients→microscopic algae (phytoplankton)→mall invertebrates (zooplankton)→forage fish→game fish. It is important to recognize that each level on the food chain ladder is produced primarily from the level immediately below it. Zooplankton, for example, are dependent on phytoplankton as a source of food. Similarly, the production of forage fishes is very closely tied to zooplankton levels.

Each step up the ladder of the food chain is accompanied by a significant total weight loss of organisms present at the new step. This is due primarily to energy expenditures (pursuit, digestion, etc.) associated with the conversion of protein from one kind of organism to another. This fact helps explain why prey animals like deer, for example, are always more abundant than the predatory mountain lions which feed on them.

Viewed in this context, the real role of a fisheries manager is to use skills and scientific knowledge to manipulate the food chain in ways which help produce desirable crops of game fishes. To do this effectively requires understanding of both fish and fishermen and familiarity with tools of the trade.

FISH STOCKING

Sometimes warmwater fish stocking programs are carried out to eliminate a biological deadend. Shortly after the age of reservoir construction began in California following World War II, it was noted that warmwater game fish species such as largemouth bass, bluegill, and catfishes preferred to live near shore where food and shelter were most abundant. Vast open-water areas, while

teaming with phytoplankton and zooplankton, were producing very little in the way of game fish. This biological observation eventually led to the importation of threadfin shad from Tennessee in the 1950's. Shad make extensive use of open-water areas in lakes and reservoirs and they are a preferred food item of predatory fishes. After shad became established in California reservoirs, successful hatchery programs were created which feature maintenance stocking of striped bass and trout; species which consume shad in open areas. This provides but one example of how a hatchery program changed a biological deadend into new and popular fisheries for anglers to enjoy.

Where use is exceptionally high, as in southern California, it may not be possible to manipulate the food chain sufficiently to meet angler demand. In recognition of this, Imperial Valley Warmwater Fish Hatchery was built in the 1970's. Large numbers of yearling channel catfish are now being stocked near metropolitan areas as part of a "put-and-take" program. Another warmwater hatchery program, which featured the stocking of largemouth bass fingerlings and yearlings, has been abandoned because of poor returns of stocked bass. This program, which was created in an effort to overcome the adverse effects of water level fluctuations on bass nesting, was apparently a failure because the shoreline areas where bass are stocked are densely populated with other fishes which "out-compete" them for food and living space.

EXOTICS

While most popular warmwater game fishes were brought to the West Coast near the turn of the century, some California reservoir fisheries have materially benefitted from more recent importations. The Florida largemouth bass, introduced into California in the 1950's, is a faster growing and harder to catch subspecies than the widely distributed northern largemouth bass. Their introduction into southern California has been an unqualified success and some spectacular trophy bass fisheries have been created. Florida bass have since been transplanted into a number of reservoirs in central California and these introductions appear to have been successful also.

Alabama spotted bass constitute another recent successful introduction. While superficially resembling largemouth bass, spotted bass build nests at depths that are relatively immune to the adverse effects of water level fluctuations on nesting success. As a case in point, Millerton Lake, Fresno-Madera counties, has been difficult to manage for black bass because of adverse effects of fluctuations on reproduction. This problem was alleviated by introducing spotted bass. Millerton Lake now supports an attractive black bass fishery. Spotted bass have been introduced into a number of additional waters in recent years and opportunities to catch this fine game fish should increase substantially in the years ahead.

Proposals to introduce new fishes into California must always receive careful scrutiny. Alien fish diseases may be brought in with new introductions and misguided anglers sometimes transfer fish into waters where they are not wanted. For example, illegal transfers of white bass from Nacimiento Lake

in the Salinas Valley into Kaweah Reservoir, Tulare County, have resulted in the creation of a white bass population which poses a threat to economically important striped bass, salmon, and steelhead fisheries in the Sacramento-San Joaquin Delta. Anglers are reminded that permission to import or plant any exotic must be obtained from the State Fish and Game Commission and the Department of Fish and Game.

REGULATIONS

Most fishing regulations are designed primarily to distribute fish crops equitably among anglers. They do not necessarily protect individual fishery resources from overharvest because use and total catch are not controlled.

In some cases, fishery managers can use angling regulations to help maintain a proper predator-prey fish balance. An example of how this might work is provided by the ever-popular largemouth bass-bluegill combination. When predator (bass)-prey (bluegill) ratios are in proper balance, bass are sufficiently numerous to keep bluegill numbers at levels which ensure rapid growth of both the bass and the bluegill. Under these conditions, fishing for both species is good. Should bass be cropped too heavily, bluegill populations can increase to levels where they become stunted and unattractive to anglers. When this occurs, black bass reproduction declines due to bluegill predation on bass eggs and young, and fishing for both species becomes poor. This commonly observed phenomenon may help explain why bag limits for top line predator species like largemouth bass are set at relatively low levels, and why minimum length limits are necessary for some waters.

HABITAT

Sometimes warmwater game fish habitat can be changed to improve the quality of available angling. A major habitat problem which adversely affects largemouth bass production is a loss of shoreline shelter as a reservoir ages. Shelter is needed both to reduce the adverse effects of wind and wave action on bass nests as well as to provide “escape cover” for young bass. When shelter is lost, nesting success is reduced and bass fisheries decline. The planting of flood-tolerant vegetation in the fluctuation zone of reservoirs is a viable method of improving warmwater fisheries habitat and a program designed to restore lost shelter by this means has been implemented in California.

Reservoir fluctuation patterns which are detrimental to fish life can sometimes be changed by cooperative agreements with water agencies. Black bass production in some southern California reservoirs, for example, has been substantially improved by minimizing water level fluctuation during spring spawning periods. Other forms of habitat improvement include the installation of brush piles and tire reefs. These devices are sometimes used to concentrate lightly utilized game fishes and increase their availability to anglers.

AGE AND GROWTH

In general, the age of a fish cannot be estimated accurately merely by observing the size of a specimen, as some fish grow faster than others of the same species. Fish managers examine fish scales, vertebrae, gill covers, or otoliths (ear bones) to age fish. These hard body parts put down rings, much as trees do, that can be counted for age determinations.

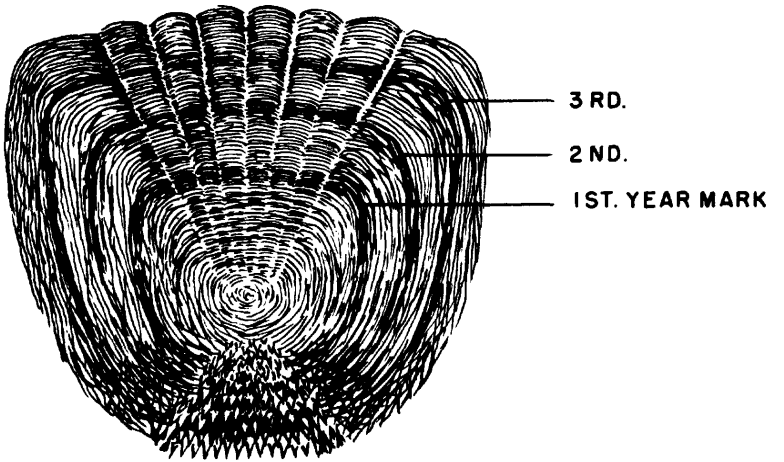

Diagram of a scale from a 16-inch largemouth bass 3½ years old, greatly enlarged. Each dark band represents the end of one year of growth.

The rate of growth depends primarily on three factors. One factor is the inherent growth characteristics of a particular species or strain. For example, spotted bass grow faster than smallmouth but slower than largemouth.

A second factor affecting growth is the length of the growing season—that is the length of time the temperature of the water is over 65°F. In Clear Lake, Lake County, a fertile natural lake, 3-year-old bass are about 15 in. long. Big Sage Reservoir, Modoc County, is also a fertile lake, but because of a short growing season, 3-year-old bass are only about 7-in long. Generally, the farther north a lake is, or the higher its elevation, the shorter the growing season.

The third major factor affecting the rate of growth, is the amount of food available. Just as some farmlands are more fertile than others, so are some waters more productive than others. In both cases, food production can be increased by the application of fertilizers. Although this can be done in the aquatic habitat, it is economically infeasible in large bodies of water, and in most reservoirs from

which running waters flush out fertilizers soon after being applied. Occasionally more food can be made available to game fish by modification of the forage base. Sometimes there is plenty of forage, but the size of individual forage organisms is too small to be utilized by large game fish. In these cases and in-between size forage organism may be the answer. Threadfin shad have filled this role very well in some waters. The shad feed on minute animals, and bass and trout feed on the shad.

New reservoirs usually have faster growing fishes than do old ones, presumably because more food is available. Abundant space in newly filled reservoirs reduces competition for food and promotes rapid growth.

SOCIAL CONSIDERATIONS

Anglers as a group constitute a diverse breed and it often is not possible to manage individual waters in ways which satisfy all of them. Casual fishermen, for example, are often most satisfied with modest to large numbers of small fish. Conversely, some experienced and dedicated anglers are willing to fish for hours or days just for the opportunity to catch a trophy-sized bass or trout. Effective fishery managers must keep abreast of public attitudes in the area of their responsibilities and must attempt to manage accordingly.

Whether or not minimum length limits are applied to individual bass or trout fisheries is often a social rather than a biological consideration. Do anglers want to creel a large number of small fish or a lesser number of larger ones? Hardly a moral or biological issue here; on the contrary, strictly a social one dependent on the views and attitudes of the angler.

Some warmwater reservoirs not containing shad can be managed to provide attractive angling for kokanee; a landlocked form of sockeye salmon which feeds on zooplankton in open-water areas. Alternative management strategy includes the introduction of threadfin shad and striped bass. While a program of this nature might produce good bass angling, the existing kokanee fishery would probably be severely reduced because shad and kokanee compete for the same food source. Again, the best strategy to follow is probably better left to the anglers to decide.